932-88 Cardiopulmonary Interactions After Fontan Operations: Augmentation of Cardiac Output Using Negative Pressure Ventilation

L.S. Shekerdemian, A. Bush, A. Petros, A.N. Redington. *Royal Brompton Hospital, London, UK*

The low cardiac output state can complicate the post-operative course of patients undergoing Fontan-like operations. In the absence of a subpulmonary ventricle, pulmonary blood flow and hence cardiac output (CO) are closely related to the mean airway pressure. We investigated the effect of negative pressure ventilation (NPV) using the Hayek oscillator on the CO of 17 fully sedated, intubated children who had undergone Fontan-like operations. 9 patients (acute) were studied in the early post-operative period, and 8 convalescent patients (conv) were studied following cardiac catheterisation. All patients were initially receiving IPPV. CO was measured using the direct Fick method during IPPV, and after 15 minutes' NPV. VO_2 was measured using respiratory mass spectrometry.

	CO (l/min/m^2)		VO_2 (ml/min/m^2)		Mixed venous sat. (%)	
	IPPV	NPV	IPPV	NPV	IPPV	NPV
All	2.5 ± 1.1	3.4 ± 1.5**	139 ± 51	153 ± 46*	63.2 ± 15.2	69.5 ± 15.7**
Acute	2.4 ± 1.2	3.4 ± 1.8*	156 ± 65	174 ± 51*	56.0 ± 17.9	62.1 ± 18.7*
Conv	2.6 ± 0.9	3.6 ± 0.8*	131 ± 19	129 ± 26	70.5 ± 17.9	78.0 ± 3.7*

Results are shown (mean ± SD) for the group as a whole (all), and for the two sub-groups. Significant changes during NPV: *$p < 0.05$; **$p < 0.001$. NPV increased CO in all patients by 44 ± 26%. There was no significant difference between the increase in CO in acute (41 ± 18%) and convalescent (47 ± 35%) groups. *Conclusion:* By reducing the mean airway pressure, NPV exploits the important cardiopulmonary interactions which exist in the Fontan circulation, and may therefore be a useful haemodynamic tool in these patients.

932-89 Outcome of Lateral Tunnel Fontan Fenestration

M. Taylor, A. Kavanaugh-McHugh, T. Graham, Jr. *Vanderbilt University Medical Center, Nashville, TN, USA*

Although the surgically created Fontan fenestration (fen.) may decrease operative morbidity and mortality at the expense of mild to moderate hypoxemia, the natural history of these defects is not known. We reviewed 37 consecutive pts. who had a fen. Fontan operation 1993–1996. Echos were performed on 30 pts. to assess fen. patency. Adequate Doppler data was available in 28 pts. Original fen. size, presence of residual fen., latest post-op. oxygen saturation (O_2 sat), clinical course, and thromboembolic events were noted. The original fen. size was 2.5 mm in 2 pts., 3.5 mm in 10 pts., and 4.0 mm in 25 pts. The mean time since surgery was 8.9 months (4 days–38 mo.). The fen. was patent by color Doppler in 26/28 pts. (93%), and the mean O_2 sat was 83% ± 13; O_2 sat. was > 95% in 4/28 pts. (11%) suggesting clinically insignificant right to left shunting in these 4 pts. Nine pts. had inadequate Doppler data to determine fen. patency: O_2 sats were 76–87% in 4 pts., 91–92% in 3 pts., 95% in 1 pt., and unavailable in 1 pt. There were no documented thromboembolic events. Three of 37 pts. had significant pleural and pericardial effusions, 2 of which had closed fenestrations. The mean O_2 sat was 86% (76–98%) in the 37 pts. Fen. size and O_2 sats were: 2.5 mm (87 & 98%, mean 92.5%), 3.5 mm (85–96%, mean 88.1%), and 4.0 mm (76–97%, mean 85.7%). There was no correlation between pt. Size and post-operative O_2 sat. The surgically created Fontan fen. rarely closed spontaneously in early follow-up, resulting in persistent cyanosis in the majority of pts. Further midterm follow-up is needed to determine if residual cyanosis and right to left shunting results in significant morbidity which could be addressed by operative or interventional catheterization closure.

932-90 Persistence of Anti-HLA Antibodies Beyond One Year in Children Receiving Cryopreserved Valved Allografts at Surgery

R.E. Shaddy, D.D. Hunter, K.A. Osborn, T.C. Fuller. *University of Utah and Primary Children's Medical Center, Salt Lake City, Utah, USA*

We have previously reported the development of a broad anti-HLA antibody response within 3 months after surgery in children who receive cryopreserved valved allografts as part of their repair of congenital heart disease. The purpose of this study was to determine whether the anti-HLA antibody response persists beyond one year and to see whether HLA specificity of the response can be determined. Panel reactive antibody (PRA) obtained in 7 children 13.9 ± 0.8 months (mean ± SE) after allograft implantation showed a small, but significant decrease at one year when compared with 3 months after surgery (Table). Use of dithiothreitol to remove IgM and to exclude autoantibody did not significantly decrease the PRA one year after surgery. This PRA was similar to the PRA reduced with dithiothreitol obtained at 3 months after surgery.

Post-surgery	PRA (%)	PRA with DTT (%)	P value
3 months	99.6 ± 0.4	92.1 ± 4.3	0.11
One year	86.7 ± 5.2	83.3 ± 6.8	0.25
P value	0.049	0.31	

HLA type was not determined on any allograft before implantation. In the only 3 patients with PRA < 85%, there were clearly defined HLA antibody specificities consistent with the HLA phenotypes of the patients; that is, the PRA was directed against major alloantigen groups that were not expressed by the antibody responders (Pt 1: HLA A1, 10, 11; Pt 2: HLA A9, 11, B8, 14, 18; Pt 3: HLA A1, 3, 11, B7, 13, 22, 27, 60). We conclude that the broad anti-HLA antibody response against cryopreserved valved allografts persists beyond one year after allograft implantation and develops some specificity.

933 Emergency Cardiac Care

Monday, March 17, 1997, Noon–2:00 p.m.
Anaheim Convention Center, Hall E
Presentation Hour: 1:00 p.m.–2:00 p.m.

933-58 Identifying the Late Presenter: Criteria for Re-focusing Heart Attack Awareness Public Education Programs: Observations from the National Registry of Myocardial Infarction-2 (NRMI-2)

R.C. Ziegelstein, J.M. Hilbe, J.M. Gore, A.J. Tiefenbrunn, W.J. French, W.J. Rogers, N.C. Chandra, for the NRMI-2 Investigators. *Johns Hopkins Medical Inst., Baltimore, MD, USA*

To better identify target populations for heart attack awareness public education programs, the NRMI-2 database was examined for variables related to time to hospital presentation. Of 133,069 patients (pts), 20.2% presented within the first hour ("early") vs. 32.6% who presented > 4 hrs after symptom onset ("late") ($p < 0.0001$). This difference was greater for women, as more than twice as many women presented late than early (35.8% vs. 17.7%, $p < 0.0001$). A larger % of Afro-Americans (37.3%) presented late as compared to Caucasians (32.2%) ($p < 0.0001$).

Compared to early presenters, pts who presented late were older (67.1 vs. 64.0 years); more likely to have a history of hypertension (50.7% vs. 44.6%) or diabetes (27.1% vs. 21.6%); and less likely to be smokers (26.9% vs. 30.1%) or to have a history of MI or PTCA/CABG (all $p < 0.0001$). Late presenters were also less likely to have hypotension (systolic BP < 100 mm Hg, 5.4% vs. 12.0%), ST elevation (41.4% vs. 57.6%) or anterior MI (27.8% vs. 31.8%) (all $p < 0.0001$). Late presenters were less likely to have commercial (21.5% vs. 28.5%) or HMO insurance (8.8% vs. 9.4%) and more likely to have Medicare (53.2% vs. 44.6%) (all $p < 0.0001$).

Multivariate analysis demonstrated that the typical late presenter was more likely to be an older minority female, without commercial or I HMO insurance, with diabetes, hypertension and tobacco use, but without known heart disease (all odds ratio > 1, $p < 0.001$). These observations suggest that public education efforts should be re-focused at specific demographic groups and payor classes.

933-59 Triage in Coronary Care Unit, Are Triaged Patients Disadvantaged?

A. Al-Mohammad, W.J.U. Philip, D.E. Harris, K.P. Jennings. *Cardiology Department, Aberdeen Royal Infirmary, Foresterhill, Aberdeen AB9 2ZB, Scotland, UK*

We studied the impact of coronary care unit (CCU) triage on the management of patients with acute chest pain. All patients seen in the triage room were prospectively entered into a database. We reviewed the notes of the patients triaged out of CCU, whose final diagnosis was myocardial infarction (MI). The diagnosis was verified in some of them, and the appropriateness of the triage decision was assessed.

Between 3.8.1995 and 31.1.1996, 1151 patients were seen through the triage system. Of those, 49% were admitted to the CCU and 51% were triaged to the medical wards. Of the latter group, 57 patients had a final discharge diagnosis of MI. However, only 43 patients had evidence of acute MI on World Health Organisation (WHO) criteria. Only 1 of the 43 patients (2.3%) had electrocardiographic (ECG) changes typical of acute myocardial

infarction on arrival, and that patient did receive thrombolytic therapy when the ECG diagnosis was reviewed. Therefore, 4.2% of all patients triaged out of CCU had MI. The accuracy in diagnosing MI in the triage room therefore, was 95.8%.

Conclusion: The introduction of CCU triage was associated with a small number of infarct patients bypassing CCU. In practice, only one of the 43 patients (2.3%) would have had earlier management by CCU admission. This would have meant 592 additional patients being admitted to CCU.

933-60 A Randomized Single Blind Trial of 2-hour Regimens of Alteplase and Streptokinase in Acute Massive Pulmonary Embolism

N. Meneveau, A. Vuillemenot, F. Schiele, B. Valette, D. Metz, P. Attali, P. Nazeyrollas, J.M. Mossard, G. Grollier, J.-P. Bassand. *Hôpital Universitaire Saint-Jacques, 25000 Besançon, France*

In massive pulmonary embolism (MPE), a 2-h regimen of streptokinase (STK) may induce as fast hemodynamic improvement as a 2-h regimen of alteplase (t-PA). 60 Pts with MPE, defined as Miller score > 17/34 and mean pulmonary artery pressure (MPA) > 20 mmHg were randomly allocated on a 1/2 basis, either to a 100 mg/2 h infusion of t-PA (21 Pts) or to a 1.5 million IU/2 h of STK (36 Pts). MPA, cardiac output (CO), and total pulmonary resistance (TPR) were serially assessed over a 12-h period using a 5-way Swan-Ganz catheter. Pulmonary angiography was performed before thrombolytic therapy (TT) and perfusion lung scan 36 h later. Relative changes in TPR over 12 h following onset of TT were:

	T1/2h	T1h*	T2h	T6h	T12h
t-PA	−20 ± 13%	−32 ± 12%	−37 ± 18%	−42 ± 19%	−45 ± 15%
STK	−14 ± 18%	−21 ± 19%	−28 ± 20%	−40 ± 22%	−48 ± 20%

A significant decrease in TPR occured in both TT groups, but more rapidly in the t-PA group compared to the STK group at 1 h (*: p = 0.01). However, the difference was no longer significant at 2 h, after completion of both TT infusions. The mean change in perfusion lung scans at 36 h was similar in both groups.

Conclusion: Improvement of TPR was achieved faster with a 2-h regimen of t-PA compared with a 2-h regimen of STK. However, catch-up phenomenon occured at the end of thrombolytic infusion.

933-61 Prehospital Thrombolysis After Cardiopulmonary Resuscitation in Suspected Myocardial Infarction

H.-R. Arntz, R. Dißmann, A. Marschalk, T. Brüggemann, S.N. Willich, D. Andresen, R. Stern, R. Agrawal, H.-P. Schultheiss. *Benjamin Franklin Medical Center, Berlin, Germany*

Cardiopulmonary resuscitation (CPR) is usually considered to be a contraindication for iv-thrombolysis (TL) in acute myocardial infarction (AMI). Since data on outcome of prehospital initiation of TL after CPR are limited, we reviewed all consecutive missions of our physician-escorted mobile coronary care unit from Jan 1992 until Dec 1995. *Results:* A total of 59 pts (age 62 ± 14 years, 64% male) with suspected AMI underwent prehospital TL (streptokinase n = 58, urokinase n = 1) after CPR. Fourteen pts had inferior, 37 anterior, 8 AMI of unclear localisation (bundle branch block). Median time from symptom-onset to CPR was 35 min and to initiation of TL 60 min. At alarm of resuce service 19 of the pts had already collapsed. In 8 pts CPR was initiated by a bystander, in 19 by an EMT, and in 32 by the emergency physician. Seventeen pts died on scene without apparent bleedings. Of the 42 pts admitted to a hospital, the cause of cardiac arrest was an AMI in 34 and pulmonary embolism in 2. In 5 pts an AMI could not be documented due to missing data in pts dying soon after admission. Of the 42 admitted pts, 29 (69%) were discharged. Thirteen pts died in the hospital (4 of these regained temporary consciousness): 9 died from a cardiac cause, 2 from bleedings, 2 had persisting coma. Beside the 2 lethal bleedings (1 intracerebral, 1 of unclear localisation with shock), severe bleedings were observed in 4 other pts. Three pts required transfusions (2 gastrointestinal, 1 oropharyngeal bleedings), 1 had a pharynx hematoma. Seven pts had minor bleedings not requiring therapy. In a multivariate analysis a CPR duration of ≥20 min was the only factor midly related to the risk of a severe bleeding complication (p = 0.07) *Conclusions:* Prehospital TL after CPR in pts with suspected AMI is associated with a promising short-term outcome but a moderate bleeding risk. Further studies are needed to determine long-term prognosis associated with this therapeutic option.

933-62 Transthoracic Defibrillation: Does Electrode Position Alter Transthoracic Impedance?

L.A. Garcia, R.E. Kerber. *University of Iowa, Iowa City, Iowa, USA*

Successful termination of ventricular fibrillation by transthoracic shocks is dependent on achieving adequate current flow, which in turn is governed by transthoracic impedance (TTI). The American Heart Association (AHA) Advanced Cardiac Life Support textbook recommends three electrode positions for defibrillation: 1) anterior/apex, 2) apex/posterior and 3) anterior/posterior. However, there are few data available comparing TTI of these positions. To study this, we applied large (78 cm^2) self-adhesive monitor-defibrillator pads to 20 subjects (10 male, 10 female, ages 21–79) and measured TTI using a validated test-pulse technique which does not require actual shocks. The electrode pads were applied in the three positions recommended by the AHA. All TTI measurements were made at end-expiration and body surface area (BSA) was recorded.

Results: (mean ± SD)

	Position:			p
	anterior/apex	apex/posterior	anterior/posterior	
TTI (ohms):	82.0 ± 24.7	71.2 ± 23.5	77.0 ± 24.7	NS

Correlation of TTI (anterior/apex placement) with BSA: TTI = 15.9 (BSA) + 46.7, r = 0.60, $p < 0.01$; the correlations of TTI and BSA were similar in the other two electrode positions. Thus, the three AHA-recommended electrode positions for transthoracic defibrillation have equivalent and acceptable TTI's; current flow should be similar using any of these positions. TTI is related to BSA in any of the three recommended positions; patients with high BSA and TTI may require higher energy selection to achieve defibrillation.

933-63 Do Transthoracic Shocks Impair LV Function in Humans?

K.M. Stein, R. Hahn, S.M. Markowitz, R.B. Devereux, B.B. Lerman. *The New York Hospital-Cornell Medical Center, New York, NY, USA*

It has been assumed that high energy DC shocks transiently depress LV performance. However, the independent effect of the shock (vs. VF and its metabolic sequelae) on ventricular function has not been systematically assessed in humans. Therefore, we studied the effects of a series of 3 synchronized "defibrillation strength" transthoracic shocks (200J, 200J and 360J) given at 60 second intervals during sinus rhythm on measures of LV chamber size and function derived from transesophageal echocardiography in 5 pts. Short axis echocardiographic images were obtained at the mid-papillary level and an area-length method was used to calculate LV volumes. In addition, the short axis image was divided into sextants, and regional wall thickening (RWT) was measured. *Results:* All pts had coronary artery disease and diminished LV function (LVEF: 14%–30%). The sequential shocks did not affect heart rate or systemic blood pressure and did not consistently alter stroke volume (SV), cardiac output (CO), LVEF, or RWT (in all 30 sextants) [all p > 0.1 by ANOVA]. Detailed analysis of RWT revealed significantly increased thickening in the worst baseline sextant (p = 0.05), but a tendency for RWT to worsen in the best sextant.

Mean ± SD	Control	200J-1	200J-2	360J
SV (ml)	65 ± 22	56 ± 17	60 ± 11	55 ± 24
CO (L/min)	4.3 ± 1.0	3.7 ± 0.9	3.9 ± 1.0	3.5 ± 1.4
LVEF (%)	22 ± 7	19 ± 6	20 ± 6	20 ± 11
RWT (mm)	0.9 ± 1.2	1.1 ± 1.3	1.3 ± 1.3	1.2 ± 1.6

However, in one pt, LVEF and CO fell from 16% to 7% and 3.4 to 1.3 L/min by the final shock.

Conclusions: Defibrillation strength transthoracic shocks do not consistently impair LV performance in pts with coronary artery disease and compromised LV function, but the effect is widely variable and, in some pts, clinically significant depression of LV function may occur.